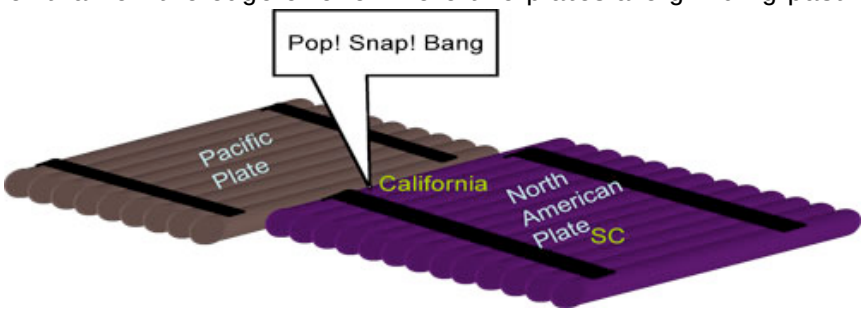
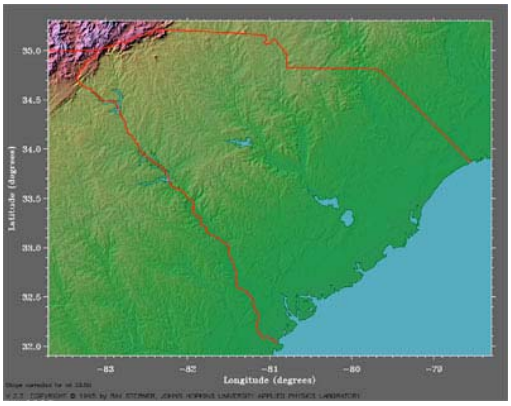
SCEEP
South Carolina Earthquake Education & Preparedness Program
College of Charleston | Dept. of Geology and Environmental Science | http://cofc.edu/~scearthquakes/

SOUTH CAROLINA EARTHQUAKES – WHY DO WE HAVE THEM?

Unlike California, South Carolina lies on what is known in geology as a 'passive margin'. This means that we are in the middle of a tectonic plate rather than on the edge of one where two plates are grinding past each other (think of the Earth as covered in log rafts, California is where 2 log rafts move past each other while South Carolina is in the middle of the North American raft).

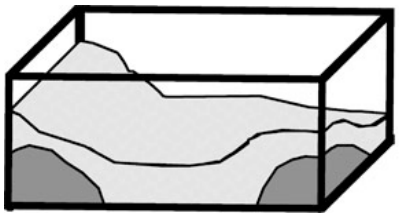


Earthquakes in California occur because of the grinding of the two plates past each other, but since there is only one plate in South Carolina we have to look for a different source or reason for our earthquakes.

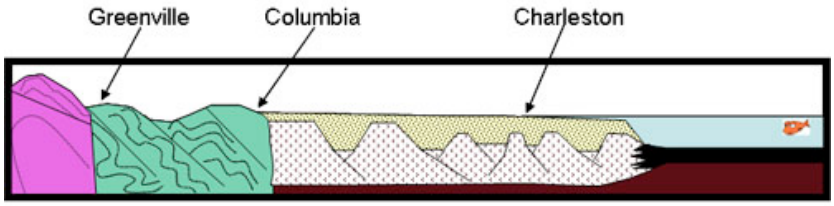


The first thing we notice is that when we look on a topographic map (a map showing changes in height of the land) of South Carolina we can see that it doesn't all look the same. Some areas of South Carolina are flat while others are hilly!

So why do some areas look different than others? In order to understand why it is hilly in Columbia, flat in Charleston, and mountainous near Clemson we need to look into the earth and see what is there. Geologists do this with something called a 'cross-section', cross-sections are like taking a piece of glass and pushing it into the earth and then scooping everything on one side away so you can see what the rocks look like from the side (a map is like looking down on sand in an aquarium and a cross-section is like looking at sand in an aquarium from the side).



Mapview (or looking down into this aquarium) would show you sand with hills, but by looking at the side of the aquarium (cross-section) we can see that there are big rocks in it holding up the hills!

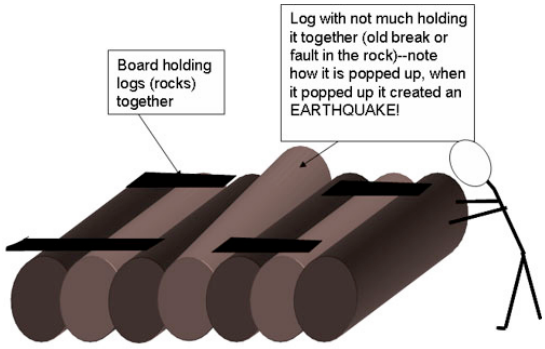


- Gneiss-very hard rock
- Slates/schists-rocks with lots of layering
- Gneisses and granites--very hard rock without lots of layering
- Sandstones, limestones, shales--softer ocean bottom type rocks
- Basalt---hard oceanic floor rocks
- Mantle---super hot rock
- Ocean
- Fault--where the rock is broken

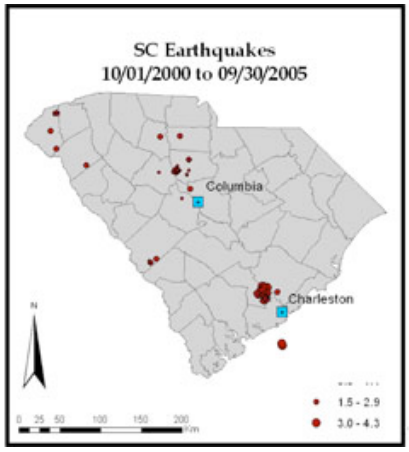
Left is a cartoon generalized cross-section of South Carolina, in it you can see that there are different types of rocks under different parts of South Carolina and that some of these rocks are folded (bent) while others are faulted (broken). Most of the folding and faulting occurred a long, long time ago (between 600 and 300 MILLION years ago!).

Most of South Carolina's earthquakes occur in the Coastal Plain where the rocks underneath are very broken up from the

break-up of Pangaea (when Africa and North America were one continent!). These cracks in the deep rocks mean that this area of the plate is weak, so if you push on the edge of the plate, some of these faults/breaks will allow the rocks to move. This is similar to a log raft where some of the logs are loose and when you push on the edge of the raft, the logs that are loose move. When the logs move they slide past each other and since they are smooth they can break off little pieces where they are sliding past and this causes earthquakes.



Why else does South Carolina have earthquakes?
If you look at the map of recent earthquakes in South Carolina, you will also see areas of small earthquakes near dams and near the Appalachian Mountains.



Map of Earthquakes in South Carolina from 2000-2005, compiled and mapped by the South Carolina Seismic Network run out of USC by Pradeep Talwani.

http://scsn.seis.sc.edu/

Dams are built to create large lakes that hold massive amounts of water, this water then slips into the cracks in the rocks and because the lakes hold so much water the water in the cracks has lots of power or pressure behind it. This pressure or power pushes the rocks apart just enough for them to slide a little, creating an earthquake. Regular rainwater doesn't do this because it doesn't have the weight or pressure of the lake behind it.

Why don't all lakes and dams have earthquakes? Dams create lots of water pressure very quickly in an area that didn't have any before, this creates a sudden change in pressure that older, slow filling lakes don't have. And some dams don't have earthquakes because the rocks are either too strong to crack or are already as cracked as they are going to get.

Remember the log raft analogy, the earth is covered with plates that move around on the surface like log rafts on a river? The mountains are like an area on the raft that has lots of logs stacked on it, this makes this part of the raft float a little lower. If you take some of the logs off, that section of the raft rises a little. The Appalachians are always being weathered, which means that the rocks they are made of are broken down into sand and mud and taken away down the rivers, this is the equivalent of slowly chipping away at those logs on the raft. So, over time the logs the Appalachians are made of are slowly rising, and occasionally they get a little stuck and when they break free they create an earthquake!